Original Report

Health Education and Cholera in Rural Guinea-Bissau

Jónína Einarsdóttir, PhD;* Alberto Passa, RN;† and Geir Gunnlaugsson, PhD‡

ABSTRACT

Objective: The study was undertaken to explore local ideas about cholera and the diffusion of official health educational messages for cholera prevention and to assess whether such messages contributed to changed behavior in the population.

Methods: During the ongoing cholera epidemic in 1994 in Guinea-Bissau, West Africa, a roster of all adult residents in a rural community was established. From this roster of 458 adults, 53 of 60 randomly chosen residents were interviewed for qualitative data on cholera and its prevention.

Results: Local preventive rituals performed contributed to high awareness of the epidemic. Radio and word-of-mouth communication were the most important sources of information on cholera, whereas posters and television did not effectively reach the population. All persons with cholera rapidly sought care. Thirty-four (64%) of 53 participants recalled at least one preventive measure; specifically, treatment of water with lemon was mentioned by 21 (40%) of respondents. None of the respondents could explain how cholera is transmitted to humans.

Conclusions: To improve compliance with recommended preventive measures, these should take local conceptions of diseases into account and be few in number, practical, and effective. The impact of the radio could be increased if those who hear the message are urged to spread the recommendation, especially to women who take care of food, water, and general hygiene in the household.

Key Words: *Africa, cholera, health education*

Int J Infect Dis 2001; 5:133–138.

*The Department of Social Anthropology, Stockholm University, Stockholm, Sweden; †The Regional Health Board of Biombo, Ministry of Public Health, Bissau, Guinea-Bissau; and ‡Centre for Child Health Services, Reykjavík, Iceland.

Alberto Passa, the regional Head Nurse of Biombo, died suddenly on April 29, 2001, at the age of 44, while tending his garden. He leaves behind his wife Dulce and their three children. He will be remembered for his friendship and great dedication to the population he served.

Supported by DanChurchAid, Copenhagen, Denmark.

Address correspondence to Dr. Geir Gunnlaugsson, Centre for Child Health Services, Barónsstíg 47, IS-101 Reykjavík, Iceland. E-mail: Geir.Gunnlaugsson@hr.is.

Throughout history cholera epidemics have been described as frightful and disastrous events, often resulting in thousands of cases and hundreds of deaths.[1,2] Fortunately, cholera transmission can be prevented, or at least limited, with adequate sanitation and improved hygienic practices, and cholera mortality can be reduced with appropriate treatment.[3,4] Improving sanitation and hygienic practices and advising persons with symptoms to promptly seek medical care are usually included in educational messages during cholera epidemics. Given the high cost of improvements in sanitation conditions, health education has been advocated as the most cost-effective intervention to prevent cholera infection.[5] Nevertheless, recently published reference books on cholera do not pay any particular attention to the subject of health education,[6,7] and only a few studies have evaluated educational efforts in relation to cholera.

A study from Ghana, conducted a decade after an epidemic, concluded that health educational messages on cholera transmitted by radio during the epidemic were not correctly recalled and when exchanged in conversation consisted mainly of misconceptions.[8] A survey of knowledge, attitudes, and practices conducted in Peru during the cholera epidemic in 1991, found that information regarding preventive measures for cholera had penetrated well into the two communities studied but had not translated into changes in practices.[9] These health education failures are shared by many other health information campaigns. According to Hubley, failures of health education can be traced to barriers at any of the six communication stages as the message passes from sender to receiver.[10,11] To be effective, the message has to (1) reach the intended audience, (2) gain attention, (3) be correctly understood, (4) be accepted, (5) result in changed behavior, and (6) result in improvement in health.

Cholera epidemics are a recent and increasing threat to public health in West Africa.[12] The first reported epidemic in Guinea-Bissau occurred in 1987,[13] and the second one in 1994.[14] Three months before the cholera epidemic in 1994 was recognized in Guinea-Bissau, in response to reports on cholera occurring in neighboring Guinea-Conakry, the Ministry of Public Health began preparations for a possible cholera epidemic. Health personnel were oriented about symptoms and treatment of cholera, and health educational material for the Guinean public was developed and broadly disseminated in the

country, both before and during the cholera epidemic. The health educational messages for the general public for the prevention of cholera were, among others, drink boiled water or water with lemon added to it, wash hands with soap, take precautions with food (cover left-over food and warm it up before eating), sweep the family compound, keep children away from dirt, build and use latrines, and keep flies away. If anyone developed diarrhea, he or she was urged to rapidly seek help at the nearest health center. These messages were given in the local languages and emitted daily by radio. In addition, a group of popular musicians made these messages into a song that was frequently played on the radio. Television was also used, but to a lesser extent, and specially trained theater groups performed for the population in the capital. Posters with prevention messages depicted by cartoons were distributed in urban areas and to the rural health centers through the Regional Health Boards. At the health centers, the health personnel were urged to give health talks on cholera prevention.

During the 1994 epidemic, cholera spread rapidly throughout the country, particularly the coastal areas; the coastal region of Biombo had the highest reported incidence (20.3 per 1000 population) outside the capital.[15] The epidemic lasted about 12 weeks, from mid-October 1994 to mid-January 1995. Guided by Hubley's six communication stages, the authors conducted a study in a rural community in the region of Biombo to explore local practices for the prevention of cholera and the diffusion of official health educational messages for cholera prevention, to identify barriers to effective health education and to assess if those messages contributed to changed behavior.

METHODS

Biombo (population 61,522) has an estimated 73 inhabitants per square kilometer and is the most densely populated of the 10 regions in Guinea-Bissau, excluding the capital, Bissau. There are 136 villages in Biombo with an average population of 316 habitants (90th centile of 1032 habitants; range, 8–3557). In the 1994 cholera epidemic, 100 villages (74%) were affected. The study village was chosen as a convenience sample, having been affected by cholera after extensive funeral ceremonies at the beginning of the epidemic.[16] The village population shares social organization and cultural customs with most other villages in the region.[17] The median distance in the region from a village to a state-operated health center is 4 km (range, 0–20 km). The study population seeks most medical and preventive health services at a health center that is 4 km away from the village.[18] The estimated population in the study village, extrapolated from the 1991 national census, was 914 persons, of whom 521 were 15 years of age and older. The village is divided into 46 distinct compounds; the huts are made of clay with thatch-roofs and dirt floors. Water is collected from dug-out wells in the compounds, the rice fields, or a natural spring. Water for daily consumption is kept in open-mouthed vessels and is neither treated with lemon nor boiled. Latrines are not used. There is no electricity or telecommunication in the village, a situation it shares with all other villages in the region, excluding the administrative center about 16 km away. There is no television, and not all households have access to a functional radio; ownership of radios is male dominated. The diet consists mainly of rice and fish boiled in lemon and hot peppers, and eaten from a common bowl with fingers. Villagers frequently visit neighboring villages or the capital, Bissau, about 40 km away, to sell their produce or see family members. Village habitants belong exclusively to the Papel ethnic group that comprises about 75% of the total regional population. The Papel speak their own language and many speak Guinean Creole as well. Most adhere to the Papel religion, and sickness is interpreted as a symbol of ritual failure or witchcraft that "comes with the wind" (i.e., is transmitted through air).[17]

Data Collection

In connection with a study on funeral practices and cholera transmission,[16] the authors visited each of the compounds in the study village between November 30 and December 4, 1994. All residents 15 years of age and older were registered. From this roster of village residents, a random sample of 60 persons was drawn, using a random number generator. Between December 10, 1994, and January 12, 1995, near the end of the epidemic, after pilot testing, qualitative information about cholera was collected from each of the randomly selected villagers. Interviews were conducted around open-ended questions, such as "What have you heard about cholera?", "How do people get cholera?", and "Have you taken any precautions regarding cholera?" The village residents were also asked if they knew of any local practices for the prevention of cholera and if they had actively taken part in such preventive measures. Guided by the answers, the conversation was directed toward questions aimed to elucidate details. All the interviews were conducted by the authors in the commonly spoken Guinean Creole language with the assistance of a Papel translator when necessary.

Data Analysis

The information from the interviews was computerized in the database program FileMakerPro, analyzed, and thereafter, categorized. For comparisons, two-tailed Fisher's exact test was calculated in JMP (v. 3.1) for Macintosh (SAS Institute Inc., Cary, NC, USA).

RESULTS

The authors identified 458 persons 15 years of age and older who lived in the study village. Interviews were completed with 53 (88%) of 60 randomly selected village residents. One of the randomly selected village residents refused to participate, and six were absent despite several return visits to their compounds. Of the 53 participants, 3 respondents reported cholera-like illness, 5 reported non-watery diarrhea, and 45 had no history of diarrhea during the cholera epidemic. Among the participants, 37 were female (70%), the median age was 33 years (range, 15-80 y), and 45 (85%) had no formal education. Eight participants (15%), one of them female, had attended 1 to 4 years of school.

Local Practices for the Prevention of Cholera

In the community, cholera was considered a new disease coming from outside and without a local name. It was classified as belonging to a group of diseases that "jumps" from one person to another. Cholera was a feared disease, because it caught so many people and killed so quickly. The same local ceremonial practices were performed to combat the epidemic as in case of disasters such as famines, droughts, wars, and measles. Offerings, including chickens and alcohol, to the spirits (*irão*) were placed at entry points to the region, around the village, and to individual households in the hopes of preventing cholera from entering. Local practices included also the designation, by religious leaders of the area, of women and men with special religious status to go to the most important shrines with offerings and requests for intervention. In addition, women gathered at the shrine of the deity named *cansaré* with offerings, danced naked in the night, and asked for help; men were not allowed to be present at the *cansaré* during the dancing. Senior women would sleep there until the epidemic was over. Of the 37 randomly selected village women, 28 (76%) were involved in the religious activities, compared with 6 (38%) of the 16 men.

Did the Health Educational Messages Reach the Intended Audience?

Of the 53 randomly selected village residents interviewed, 50 (94%) reported hearing or seeing one or more health educational message on cholera during the epidemic. The three persons who reported not hearing or seeing messages were elderly and appeared to be confused in what concerned on-going community activities.

Radio was the most common source of health educational messages for the prevention of cholera (Table 1). Almost half of the respondents had heard cholera information on the radio. In contrast, only one person, on a visit in Bissau, had seen a health educational message on television. Although no health educational posters were seen in the village, about 24% had noticed posters either at the local health center or in Bissau. Several respondents heard or saw the messages in several media, particularly radio and posters. Importantly, about 40% of respondents reported not hearing or seeing the messages directly but being told about them by family members or friends (word-of-mouth). Two persons claimed to have received cholera information from a health worker. The sources of health educational messages did not vary according to gender, age, or education of the respondents.

Table 1. Dissemination, Sources of Information, and Understanding of Preventive Health Educational Messages among Randomly Selected Adult Residents in the Study Village: Biombo, Guinea-Bissau 1994*

	Health Message	
Source of Information	*Reached Intended Audience† n (%)*	*Partially Understood‡ n (%)*
Radio	24 (45)	15 (63)
Television	1 (2)	0
Poster	13 (24)	1 (7)
Health staff	2 (4)	1 (50)
Word-of-mouth	22 (41)	14 (64)

*Random sample of 60 adults with 53 respondents; †some respondents may have been reached by several communication channels; ‡partial understanding defined as the ability to state at least one of the prevention recommendations promoted by the health authorities; each respondent with partial understanding assigned to only one category of source of information.

Was the Health Message Understood and Accepted?

Thirty-four (68%) of 50 respondents who reported hearing or seeing health educational messages on cholera could state at least one of the prevention messages for cholera; 19 (38%) could state three or more of the prevention messages. There were no significant differences by gender, age, or education in the proportion of respondents who could state at least one prevention message compared with those who were unable to state any message.

Of those who had heard the health educational messages about cholera on radio, 15 (63%) of 24 could explain at least one of the prevention messages (see Table 1). Among those who had heard the messages on the radio, 7 (88%) of 8 males recalled one or more prevention messages compared with 8 (50%) of 16 females ($P = 0.1782$). The respondents who had heard the messages on the radio but could not explain at least one prevention message apparently did not understand the messages because of language problems, or because they believed the matter was too complicated. The respondent who had seen the prevention message on television could not recall its message. Only 1 (8%) of 13 who had seen posters could explain at least one of the prevention messages; the other 12 apparently did not understand the cartoons on the posters at all. Several stated: "How can I understand a poster? I do not know how to read or write." Of the respondents who reported not hearing or seeing the health educational messages

directly, but being told about them by a family member or friend, 14 (64%) of 22 respondents could explain at least one of the prevention messages. Learning about the health educational messages from family members and friends was especially important for women—12 of the 14 persons who learned about the messages through this means were women.

As for the individual prevention messages, women were more likely to recall the recommendation to treat drinking water, particularly using lemons. Twenty (54%) of 37 women mentioned the use of lemon for prevention of cholera compared to 1 (6%) of 16 men (P = 0.0016). However, there was some confusion about the proper use of lemon; most respondents put lemon into the drinking water but some drank pure lemon, others mixed it with salt and hot pepper, and still others lamented not to have an easy access to locally distillate alcohol, as it, mixed with lemon, was considered to be a good medicine for cholera. There were no other differences between males and females concerning knowledge of the prevention messages.

In general, respondents did not oppose the health educational messages as such, although one woman wondered why mothers were urged to keep their children away from the dirt of the compound: "Where else can we have them?" she asked. However, although the health educational messages were heard or seen, directly or indirectly, by most, could be repeated by many, and were acceptable to almost all, no respondent knew how cholera entered the human body. Some respondents mentioned that cholera *bim cu vento*; that is, cholera came with the wind and was around in the air, but no respondent knew that cholera entered the body on food or water contaminated by the feces of a person with cholera.

Did Health Education Change Behavior?

Many respondents followed the recommended handling of drinking water; 35 (66%) of 53 respondents had consumed water to which lemon was added for prevention of cholera, and 27 (77%) liked the taste of it. Boiled water had been used by 21 (40%) of 53 respondents, and 14 (67%) approved its taste. Thirty-six (70%) of 53 respondents had drunk either lemon water or boiled water; yet, none reported always drinking treated water during this epidemic. There were no differences by gender, age, or education among persons who did or did not drink lemon water or boiled water. A common response among those who disliked lemon water or boiled water was: "There is no choice, you have to drink it in the same way you have to drink whatever bitter medicine."

Cholera was seen as a fearful disease likely to result in death if left untreated. When cholera was suspected, it was seen as urgent to seek treatment at the nearest health center, as recommended by health authorities. In the village, no latrine was constructed during the epidemic.

DISCUSSION

In the setting of a rural village in Guinea-Bissau in the midst of an ongoing cholera epidemic, this study explored the dissemination of health educational messages for prevention of cholera. The prevention messages had reached most of the randomly selected villagers and had gained their attention, principally through radio or word-of-mouth. However, proper understanding and compliance with most of the recommended behavioral changes was limited. Contributory factors to such an outcome may have been the diversity of prevention messages promoted as well as their impracticality for most of the intended audience. The most serious result is that no villager could explain the proper transmission of cholera.

The results of the study reinforce both the importance of the radio for direct, and word-of-mouth (person-to-person conversation) for indirect dissemination of the message for prevention of cholera; similar findings have been reported elsewhere.[8,9,19] Despite limited access to radio in the study village, it was the most important conduit for cholera information. When time is limited and resources and manpower are lacking, the radio is the most immediate media for information in Guinea-Bissau. Common people frequently use radio for announcements of deaths and other urgent messages. In addition, the effectiveness of word-of-mouth communication in the studied community was impressive; those who had heard cholera prevention messages on the radio were just as likely to recall at least one prevention message (63%), as those who got information on cholera only through informal conversation (64%). These findings suggest that word-of-mouth communication can be an important multiplier of prevention messages, and educators may wish to encourage this vehicle in their public health messages.

In contrast, few persons received cholera education at the health center at 4 km distance from the village. During the epidemic, the only nurse serving the health center was fully occupied treating patients with cholera, furthermore persons who were not sick with cholera avoided the health center. In the study setting, posters were ineffective for health education, because illiteracy is high, access to printed material lacking, and exposure to pictures limited. Seemingly, those who were illiterate often took for granted that they would not understand the message of a poster; similar difficulties in understanding visual aids have been found elsewhere within rural communities with a low level of education.[10,20] An alternative to designed posters in Africa might be the use of photographs, because they are easier to understand and preferred.[21] In Guinea-Bissau, preparations are underway for such an approach in future epidemics.

Although a proportion of respondents directly or indirectly heard or saw the cholera prevention messages and could recall one or more messages, the transmission route of cholera was not understood. Villagers had some-

what confused ideas about cholera being around in the air, without being able to explain how it entered the human body. The expression *bim cu bento* ("comes with the wind") was used to explain the transmission of cholera. The notion that diseases are transmitted through air is common in Guinea-Bissau and elsewhere in West Africa.[22] Interestingly, in Japan, many attributed the cause of a recent epidemic poisoning of food to bacteria that could be transmitted through physical contact or through the air.[23] Although local perceptions on the propagation of diseases may be a barrier that prevents proper understanding of the transmission of cholera, local ritual preventive practices contributed to high awareness of the epidemic. Health authorities could take advantage of this community engagement. Most importantly, information to the public in general but religious leaders in particular should explain that cholera does not "jump" in the air but enters the human body through the mouth with contaminated water or food.

The health educational information given in Guinea-Bissau did not describe cholera transmission well. The prevention messages placed undue focus on environmental hygiene that may have contributed to the lack in the understanding of cholera transmission. Recommendations such as to build and use latrines, not to play in the dirt, to sweep the house or kill flies, besides being ineffective in preventing transmission, take the focus away from preventing contamination of food and water. The behaviors advocated in a health educational campaign should be relevant for the health problem in question and must lead to improvement in health.[10,24,25] The more actions a community is asked to perform, the less likely it is to perform any of them; recommendations should be practical, effective, and few in number.

To change behavior, the health educational message has to be accepted and the required enabling factors provided (e.g., resources, skills, and time).[11] In that perspective, an additional important result of the present study is the high acceptance of villagers to use lemons for the treatment of drinking water during the epidemic. Lemon juice has been shown to be an effective measure to kill vibrios in food[26,27] and having access to lemons at home is associated with less risk of cholera infection during an epidemic.[28] In Biombo region, lemons are readily available, and most households are self-sufficient. Although lemons are an essential ingredient for cooking, they are not commonly used in drinking water. Further, lemons are used locally for the treatment of diarrhea. Lemon water was better accepted in the studied community than boiled water, which requires more work and resources to prepare. Nevertheless, nobody reported always drinking treated water during the epidemic; the notion that lemon was a kind of medicine may have contributed to such an outcome. No latrine was built in the village, contrary to repeated recommendation in health educational messages transmitted by radio.

Most of the health educational prevention messages during the 1994 cholera epidemic in Guinea-Bissau related to tasks performed by women. Thus, to evaluate the appropriateness of a health message it is essential to take into account their access to information, their level of education, and their multiple roles and heavy workload. In this study, women were less likely than men to mention radio as their source of information, yet, they did not differ from men in their understanding of preventive behaviors. Women were indeed more concerned with the importance of using lemon for prevention of cholera than were men. However, men were as likely as women to drink lemon water or boiled water, which demonstrates the central role of women in preparing the drinking water for the whole family.

The health educational message was effective in urging people to seek care rapidly but ineffective in preventing transmission: all heard, none understood. The recommendation to seek medical help for cholera symptoms was taken seriously by the villagers and thereby many lives may have been saved.[15] Only one village resident died of cholera, at the beginning of the epidemic, when consciousness of the epidemic was still low. Considering the otherwise similar responses given by those who reported cholera-like illness and those who reported no diarrhea, observed lack of insight into the routes of cholera transmission, and the somewhat unfocused and diverse preventive actions mentioned, the authors conclude that the reduction of cholera transmission as a result of health education was probably minimal.

This study explored through qualitative interviews how official health educational messages on cholera were disseminated in one, rural village in Biombo region during an ongoing cholera epidemic. The study village has no access to tap water, electricity, telecommunication, or television, a situation it shares with almost all other villages in the region, along with demographic characteristics. Yet, it is one of the larger villages, with frequent contacts with the capital, Bissau, and knowledge of cholera prevention could be even more limited in other, smaller villages in the region.

CONCLUSIONS

The study demonstrates the effectiveness of the radio in combination with word-of-mouth communication for dissemination of health messages in a rural community in West Africa. The radio would likely be more effective in health education for prevention of cholera if the routes of transmission of cholera were properly explained with due consideration given to local competing ideas about transmission of diseases; further, the number of preventive recommendations must be reduced to include only a few key practices essential for the prevention of cholera. It is important to suggest to people who hear the

message that they explain it to those who do not hear or understand what is said. Lastly, this study verified a high acceptance for using lemon to guarantee safe water—a simple and culturally acceptable message that in future epidemics may prove appropriate elsewhere in Africa.

ACKNOWLEDGMENTS

This study would never have been completed without the help and cultural guidance of Odete Flex, Armindo Indjai, Sã António Mentambanar, Afonso Té, and Biou Có. The authors also thank Frederick J. Angulo and Robert V. Tauxe, Centers for Disease Control and Prevention, Atlanta, Georgia, USA, for discussions and constructive comments on earlier versions of this article.

REFERENCES

1. Pollitzer R. Cholera. Geneva: World Health Organization, 1959.
2. Rosenberg CE. The cholera years. The United States in 1832, 1849, and 1866. 2nd ed. Chicago: The University of Chicago Press, 1987.
3. Mintz ED, Popovic T, Blake PA. Transmission of *Vibrio cholerae* 01. In: Wachsmuth K, Blake PA, Olsvik Ø, eds. *Vibrio cholerae* and cholera: molecular to global perspectives. Washington, DC: American Society for Microbiology, 1994:345-356.
4. Kaper JB, Morris JG Jr, Levine MM. Cholera. Clin Microbiol Rev 1995; 8:48-86.
5. Guthmann JP. Epidemic cholera in Latin America: spread and routes of transmission. J Trop Med Hyg 1995; 98:419-427.
6. World Health Organization. Guidelines for cholera control. Geneva: WHO, 1993.
7. Wachsmuth K, Blake PA, Olsvik Ø, eds. *Vibrio cholerae* and cholera: molecular to global perspectives. Washington, DC: American Society for Microbiology, 1994.
8. Bosompra K. Dissemination of health information among rural dwellers in Africa: a Ghanaian experience. Soc Sci Med 1989; 29:1133-1140.
9. Quick RE, Gerber ML, Palacios AM, et al. Using a knowledge, attitudes, and practises survey to supplement findings of an outbreak investigation: cholera prevention measures during the 1991 epidemic in Peru. Int J Epidemiol 1996; 25:872-878.
10. Hubley JH. Barriers to health education in developing countries. Health Educ Res 1986; 1:233-245.
11. Hubley J. Communicating health: an action guide to health education and health promotion. London: MacMillan Press, 1993.
12. Swerdlow DL, Isaäcson M. The epidemiology of cholera in Africa. In: Wachsmuth K, Blake PA, Olsvik Ø, eds. *Vibrio cholerae* and cholera: molecular to global perspectives. Washington, DC: American Society for Microbiology, 1994:297-307.
13. Shaffer N, Mendes P, Costa CM, et al. Epidemic cholera in Guinea-Bissau: importance of foodborne transmission [Abstract]. Los Angeles, Washington, DC: American Society of Microbiology, 1988:360.
14. World Health Organization. Cholera in 1994. Part I. Wkly Epidemiol Rec 1995; 70:201-208.
15. Gunnlaugsson G, Angulo FJ, Einarsdóttir J, Passa A, Tauxe RV. Epidemic cholera in Guinea-Bissau: the challenge of preventing deaths in rural West Africa. Int J Infect Dis 1999; 4:8-15.
16. Gunnlaugsson G, Einarsdóttir J, Angulo FJ, Mentambanar SA, Passa A, Tauxe RV. Funerals during the 1994 cholera epidemic in Guinea-Bissau, West Africa: the need for disinfection of bodies of persons dying of cholera. Epidemiol Infect 1998; 120:7-15.
17. Einarsdóttir J. "Tired of weeping": child death and mourning among Papel mothers in Guinea-Bissau. Stockholm Studies in Anthropology No. 46. Stockholm: Almquist and Wiksell, 2000.
18. Gunnlaugsson G. Biombo: annual report 1996. Quinhamel/Copenhagen: DanChurchAid, 1997.
19. Friedman CR. Trip report: cholera epidemic, Cape Verde Islands, October 1995. Atlanta, GA: Centers for Disease Control and Prevention, 1995.
20. Gustafson MB. A look at pictorial literacy. Hygie 1986; V:9-13.
21. Moynihan M, Mukherjee U. Visual communication with nonliterates: a review of current knowledge including research in northern India. Int J Health Educ 1981; 24:251-262.
22. Castle SE. The (re)negotiation of illness diagnoses and responsibility for child death in rural Mali. Med Anthropol Q 1994; 8:314-335.
23. WuDunn S. Elusive germ sows panic in Japan. New York Times International, August 23, 1996, Sect. A:6-7.
24. Feachem RG. Intervention for the control of diarrhoeal diseases among young children: promotion of personal and domestic hygiene. Bull WHO 1984; 3:467-476.
25. Kirchhoff LV, McClelland KE, do Carmo Pinho MC, Araujo JG, de Sousa MA. Feasibility and efficiacy of in-home water chlorination in rural north-eastern Brazil. J Hyg (Lond) 1985;94:173-180.
26. Mata L, Vargas C, Saborio D, Vives M. Extinction of *Vibrio cholerae* in acidic substrata: contaminated cabbage and lettuce treated with lime juice. Rev Biol Trop 1994; 42:487-492.
27. Mata L, Vives M, Vicente G. Extinction of *Vibrio cholerae* in acidic substrata: contaminated fish marinated with lime juice (ceviche). Rev Biol Trop 1994; 42:479-485.
28. Rodrigues A, Brun H, Sandström A. Risk factors for cholera infection in the initial phase of an epidemic in Guinea-Bissau: protection from lime juice. Am J Trop Med Hyg 1997; 57:601-604.